DexCom's App. No. 11/334,876	ADC's Say et al. App. No. 10/783,675	Comments
Claim 14 (Independent) (Currently Amended)	**Claim 55 (amended)**	
A device for monitoring glucose concentration in a biological sample of a host, the device comprising:	A device for monitoring glucose concentration in a biological sample of a host, the device comprising:	The present invention relates to devices and methods for the in vivo monitoring of an analyte using an electrochemical sensor to provide information to a patient about the level of the analyte. (Field of Invention).
a substantially continuous glucose sensor that produces a data stream indicative of a glucose concentration in a host, the data stream comprising a plurality of time spaced sensor data points;	a substantially continuous glucose sensor that produces a data stream indicative of a glucose concentration in a host, the data stream comprising a plurality of time spaced sensor data points;	The on-skin sensor control unit 44 also typically includes at least a portion of the electronic components that operate the sensor 42 and the analyte monitoring device system 40. One embodiment of the electronics in the on-skin control unit 44 is illustrated as a block diagram in FIG. 18A. The electronic components of the on-skin sensor control unit 44 typically include a power supply 95 for operating the on-skin control unit 44 and the sensor 42, **a sensor circuit 97 for obtaining signals from and operating the sensor 42**, a measurement circuit 96 that converts sensor signals to a desired format, and **a processing circuit 109 that, at minimum, obtains signals from the sensor circuit 97** and/or measurement circuit 96 and provides the signals to an optional transmitter 98. (Pages 60-61; lines 27-30 and 1-8). Additionally: Typically, **data is transmitted to the receiver/display unit 46, 48 at least every hour, preferably, at least every fifteen minutes, more preferably, at least every five minutes, and most preferably, at least every one minute**. (Page 71; lines 17-19).

an integrated receiver that receives the data stream from the substantially continuous glucose sensor, wherein the integrated receiver comprises:	an integrated receiver that receives the data stream from the substantially continuous glucose sensor, wherein the integrated receiver comprises:	One or more receiver/display units 46, 48 may be provided with the analyte monitoring device 40 for easy access to the data generated by the sensor 42 and may, in some embodiments, process the signals from the on-skin sensor control unit 44 to determine the concentration or level of analyte in the subcutaneous tissue. (See Page 79; lines 5-8).
a single point glucose monitor configured to receive a biological sample from the host and to measure the concentration of glucose in the sample, the measured glucose concentration comprising a reference data point;	a single point glucose monitor configured to receive a biological sample from the host and to measure the concentration of glucose in the sample, the measured glucose concentration comprising a reference data point;	In another embodiment, the receiver/display unit 46, 48 is integrated with a calibration unit (not shown). For example, the receiver/display unit 46, 48 may, for example, include a conventional blood glucose monitor. Another useful calibration device utilizing electrochemical detection of analyte concentration is described in U.S. patent application Ser. No. 08/795,767, incorporated herein by reference. Other devices may be used including those that operate using, for example, electrochemical and colorimetric blood glucose assays, assays of interstitial or dermal fluid, and/or non-invasive optical assays. When a calibration of the implanted sensor is needed, the patient uses the integrated in vitro monitor to generate a reading. The reading may then, for example, automatically be sent by the transmitter 160 of the receiver/display unit 46, 48 to calibrate the sensor 42. (Page 89; lines 13-23).
a ~~microprocessor~~ processor; and a computer readable memory comprising: instructions configured to cause the ~~microprocessor~~ processor to process the data stream received from the continuous glucose	a ~~microprocessor~~ processor; and a computer readable memory comprising: instructions configured to cause the ~~microprocessor~~ processor to process the data stream received from the continuous glucose sensor;	The receiver/display units 46, 48, as illustrated in block form at FIG. 22, typically include a receiver 150 to receive data from the on-skin sensor control unit 44, an analyzer 152 to evaluate the data, a display 154 to provide information to the patient, and an alarm system 156 to warn the patient when a condition arises. The receiver/display units 46, 48 may also optionally include a data storage device 158, a transmitter 160, and/or an input device 162. The receiver/display units 46, 48 may also include other

sensor;		components (not shown), such as a power supply (e.g., a battery and/or a power supply that can receive power from a wall outlet), a watchdog circuit, a bias current generator, and an oscillator. These additional components are similar to those described above for the on-skin sensor control unit 44. (Page 79, lines 21 to Page 80, line 2). Functions of the analyte monitoring system 40 and the sensor control unit 44 may be implemented using either software routines, hardware components, or combinations thereof. The hardware components may be implemented using a variety of technologies, including, for example, integrated circuits or discrete electronic components. The use of integrated circuits typically reduces the size of the electronics, which in turn may result in a smaller on-skin sensor control unit 44. (Page 62; lines 15-20).
instructions configured to cause the ~~microprocessor~~ processor to determine a rate of change of the data stream from the substantially continuous analyte sensor; and	instructions configured to cause the ~~microprocessor~~ processor to determine a rate of change of the data stream from the substantially continuous analyte sensor; and	Returning to the receiver 150, the data received by the receiver 150 is then sent to an analyzer 152. The analyzer 152 may have a variety of functions, similar to the processor circuit 109 of the on-skin sensor control unit 44, including ... 4) determining if the level, rate of change, and/or acceleration in the rate of change of the analyte exceeds or meets one or more threshold values. (Page 83; lines 5-18).
instructions configured to cause the ~~microprocessor~~ processor to calibrate the data stream using the glucose concentration measured by the single point glucose monitor.	instructions configured to cause the ~~microprocessor~~ processor to calibrate the data stream using the glucose concentration measured by the single point glucose monitor.	The processing circuit 109 of the on-skin sensor control unit 44 and/or an analyzer 152 of the receiver/display unit 46, 48 may determine when calibration data is needed and if the calibration data is acceptable. (Page 73; lines 15-17). Calibration data may be obtained in a variety of ways. For

		instance, the calibration data may simply be factory-determined calibration measurements which can be input into the on-skin sensor control unit 44 using the receiver 99 or may alternatively be stored in a calibration data storage unit 100 within the on-skin sensor control unit 44 itself (in which case a receiver 99 may not be needed). The calibration data storage unit 100 may be, for example, a readable or readable/writeable memory circuit. (Page 72; lines 7-13) In another embodiment, the receiver/display unit 46, 48 is integrated with a calibration unit (not shown). For example, the receiver/display unit 46, 48 may, for example, include a conventional blood glucose monitor. (Page 89; lines 13-15).
Claim 26 (currently amended)	Claim 69 (currently amended)	
The device of claim 14, further comprising a user interface, wherein the user interface is configured to request additional reference data when the rate of change of the data stream is ~~above~~ below a predetermined threshold.	The device of claim 55, further comprising a user interface, wherein the user interface is configured to request additional reference data when the rate of change of the data stream is ~~above~~ below a predetermined threshold.	In some embodiments of the invention, calibration data may be required at periodic intervals, for example, every eight hours, once a day, or once a week, to confirm that accurate analyte levels are being reported. Calibration may also be required each time a new sensor 42 is implanted **or if the sensor exceeds a threshold minimum or maximum value or if the rate of change in the sensor signal exceeds a threshold value**. (Page 72; line 26 to Page 73; line 2) One example of a receiver/display unit 46, 48 is illustrated in FIG. 23. The display 154 of this particular receiver/display unit 46, 48 includes a portion 164 which displays the level of the analyte, for example, the blood glucose concentration, as determined by the processing circuit 109 and/or the analyzer 152 using signals from the sensor 42. The display also includes various indicators 166 which may be activated under certain conditions. For example, the indicator 168 of a glucose monitoring device may be activated if the patient is hyperglycemic. Other indicators may be activated in the cases of

		hypoglycemia (170), impending hyperglycemia (172), impending hypoglycemia (174), a malfunction, an error condition, **or when a calibration sample is needed (176).** (Page 84; lines 4-13).
Claim 27 (new)	**Claim 70 (new)**	
The device of claim 14, wherein the computer readable memory further comprises instructions configured to cause the processor to receive user information from an external source and process the user information received from the external source.	The device of claim 55, wherein the computer readable memory further comprises instructions configured to cause the processor to receive user information from an external source and process the user information received from the external source.	The receiver/display units 46, 48, as illustrated in block form at FIG. 22, typically include a receiver 150 to receive data from the on-skin sensor control unit 44, an analyzer 152 to evaluate the data, a display 154 to provide information to the patient, and an alarm system 156 to warn the patient when a condition arises. The receiver/display units 46, 48 may also optionally include a data storage device 158, a transmitter 160, and/or an input device 162. (Page 79; lines 21-26). The receiver/display units 46, 48 may also include a number of optional items. One item is a data storage unit 158. ... The data storage unit 158 may also be activated to store data when a directed by the patient via, for example, the optional input device 162. (Page 86; lines 19-29). The data storage unit 158 may also be configured to store data upon occurrence of a particular event, such as a hyperglycemic or hypoglycemic episode, exercise, eating, etc. The storage unit 158 may also store event markers with the data of the particular event. These event markers may be generated either automatically by the display/receiver unit 46, 48 or through input by the patient. (Page 86, line 29 to page 87, line 5) Functions of the analyte monitoring system 40 and the sensor control unit 44 may be implemented using either software routines, hardware components, or combinations thereof. The hardware components may be implemented using a variety of

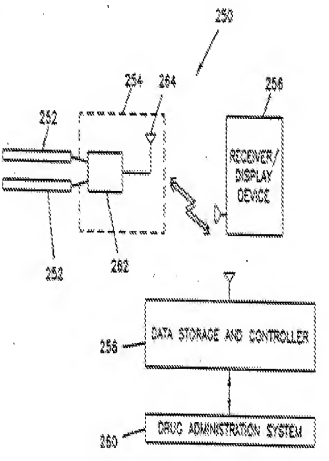
		technologies, including, for example, integrated circuits or discrete electronic components. The use of integrated circuits typically reduces the size of the electronics, which in turn may result in a smaller on-skin sensor control unit 44. (Page 62; lines 15-20). The analyte monitoring system also includes a display unit that has a receiver for receiving data from the sensor control unit and a display coupled to the receiver for displaying an indication of the level of an analyte. The display unit may optionally include a variety of components, such as, for example, a transmitter, an analyzer, a data storage unit, a watchdog circuit, **an input device**, a power supply, a clock, a lamp, a pager, a telephone interface, **a computer interface**, an alarm or alarm system, a radio, and a calibration unit.
Claim 28 (new)	**Claim 71 (new)**	
The device of claim 27, wherein the user information comprises information selected from the group consisting of mealtime information, exercise information, insulin administration, therapy recommendations and reference analyte values.	The device of claim 70, wherein the user information comprises information selected from the group consisting of mealtime information, exercise information, insulin administration, therapy recommendations and reference analyte values.	The data storage unit 158 may also be configured to store data upon occurrence of a particular event, such as a hyperglycemic or hypoglycemic episode, exercise, eating, etc. The storage unit 158 may also store event markers with the data of the particular event. These event markers may be generated either automatically by the display/receiver unit 46, 48 or through input by the patient. (Page 86, line 29 to page 87, line 5)

Claim 29 (new)	**Claim 72 (new)**	
The device of claim 14, wherein the computer readable memory further comprises instructions configured to detect at least one of present hypoglycemia, predicted hypoglycemia, present hypergylcemia and predicted hypoglycemia, wherein the instructions are configured to trigger an alarm or alert in response to the detection.	The device of claim 55, wherein the computer readable memory further comprises instructions configured to detect at least one of present hypoglycemia, predicted hypoglycemia, present ~~hypergylcemia~~ hyperglycemia and predicted ~~hypoglycemia~~ hyperglycemia, wherein the instructions are configured to trigger an alarm or alert in response to the detection.	The receiver/display units 46, 48 also typically include an alarm system 156. The options for configuration of the alarm system 156 are similar to those for the alarm system 104 of the on-skin sensor control unit 44. For example, if glucose is the analyte, than the on-skin sensor control unit 44 may include an alarm system 156 that warns the patient of conditions such as hypoglycemia, hyperglycemia, impending hypoglycemia, and/or impending hyperglycemia. (Page 84, line 25 to page 85, line 1). The sensor control unit 44 and/or the receiver/display units 46, 48 may display or otherwise communicate the current level of the analyte. Furthermore, the sensor control unit 44 and/or the receiver/display units 46, 48 may indicate to the patient, via, for example, an audible, visual, or other sensory-stimulating alarm, when the level of the analyte is at or near a threshold level. In some embodiments, a electrical shock can be delivered to the patient as a warning through one of the electrodes or the optional temperature probe of the sensor. **For example, if glucose is monitored then an alarm may be used to alert the patient to a hypoglycemic or hyperglycemic glucose level and/or to impending hypoglycemia or hyperglycemia.**
Claim 30 (new)	**Claim 73 (new)**	
The device of claim 14, wherein the integrated receiver comprises a user interface configured to display continuous glucose sensor data and single point glucose monitor data.	The device of claim 55, wherein the integrated receiver comprises a user interface configured to display continuous glucose sensor data and single point glucose monitor data.	In another embodiment, the receiver/display unit 46, 48 is integrated with a calibration unit (not shown). For example, the receiver/display unit 46, 48 may, for example, include a conventional blood glucose monitor. Another useful calibration device utilizing electrochemical detection of analyte concentration is described in U.S. patent application Ser. No. 08/795,767, incorporated herein by reference. Other devices may be used including those that operate using, for example, electrochemical and colorimetric blood glucose assays, assays of

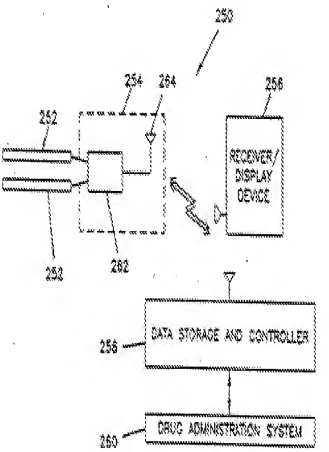
		interstitial or dermal fluid, and/or non-invasive optical assays. When a calibration of the implanted sensor is needed, **the patient uses the integrated in vitro monitor to generate a reading.** The reading may then, for example, automatically be sent by the transmitter 160 of the receiver/display unit 46, 48 to calibrate the sensor 42. (Page 89, lines 13-23).
Claim 31 (new)	**Claim 74 (new)**	
The device of claim 14, wherein the computer readable memory further comprises instructions configured to process and send data to an external device.	The device of claim 55, wherein the computer readable memory further comprises instructions configured to process and send data to an external device.	The receiver/display unit 46, 48 may also include an optional transmitter 160 which can be used to transmit 1) calibration information, 2) a signal to direct the transmitter 98 of the on-skin sensor control unit 44 to change transmission frequency or frequency bands, and/or 3) a signal to activate an alarm system 104 on the on-skin sensor control unit 44, all of which are described above. (Page 87; lines 6-10). As another example, a receiver/display unit 46, 48 may transmit data to a computer in the patient's home or at a doctor's office. (Page 87; lines 24-26).
Claim 32 (new)	**Claim 75 (new)**	
The device of claim 31, wherein the instructions configured to process and send data to an external device are configured to process and send at least one of an alert, a warning, and a message to a telecommunication device.	The device of claim 74, wherein the instructions configured to process and send data to an external device are configured to process and send at least one of an alert, a warning, and a message to a telecommunication device.	As another example, a receiver/display unit 46, 48 may transmit data to a computer in the patient's home or at a doctor's office. Moreover, the transmitter 160 or a separate transmitter may direct a transmission to another unit or to a telephone or other communications device that alerts a doctor or other individual when an alarm is activated and/or if, after a predetermined time period, an activated alarm has not been deactivated, suggesting that the patient may require assistance. In some embodiments, the receiver/display unit is capable of one-way or two-way paging and/or is coupled to a telephone line to send and/or receive messages from another, such as a health professional monitoring the patient. (Page 87, line 24 to page 88, line 3).

Claim 33 (new)	**Claim 76 (new)**	
The device of claim 31, wherein the instructions configured to process and send data to an external device are configured to process and send a therapy recommendation to an insulin delivery device.	The device of claim 74, wherein the instructions configured to process and send data to an external device are configured to process and send a therapy recommendation to an insulin delivery device.	Integration With a Drug Administration System FIG. 25 illustrates a block diagram of a sensor-based drug delivery system 250 according to the present invention. The system may provide a drug to counteract the high or low level of the analyte in response to the signals from one or more sensors 252. Alternatively, the system monitors the drug concentration to ensure that the drug remains within a desired therapeutic range. The drug delivery system includes one or more (and preferably two or more) subcutaneously implanted sensors 252, an on-skin sensor control unit 254, a receiver/display unit 256, a data storage and controller module 258, and a drug administration system 260. In some cases, the receiver/display unit 256, data storage and controller module 258, and drug administration system 260 may be integrated in a single unit. The sensor-based drug delivery system 250 uses data form the one or more sensors 252 to provide necessary input for a control algorithm/mechanism in the data storage and controller module 252 to adjust the administration of drugs. As an example, a glucose sensor could be used to control and adjust the administration of insulin. (Page 89; line 26 to Page 90; line 10). A processor 262 in the on-skin sensor control unit 254, as illustrated in FIG. 25, or in the receiver/display unit 256 determines the level of the analyte, and possibly other information, such as the rate or acceleration of the rate in the increase or decrease in analyte level. This information is then transmitted to the data storage and controller module 252 using a transmitter 264 in the on-skin sensor control unit 254, as illustrated in FIG. 25, or a non-integrated receiver/display unit

		256. (Page 90; lines 14-19). In one embodiment, the data storage and controller module 258, processing circuit 109, and/or analyzer 152 utilizes patient-specific data from multiple episodes to predict a patient's response to future episodes. (Page 91; lines 14-16) By analyzing multiple episodes, the data storage and controller module 258, processing circuit 109, and/or analyzer 152 can predict the coarse of a future episode and provide, for example, a drug administration protocol or administer a drug based on this analysis. (Page 91; lines 22-25). The analyte monitor may also be part of a drug delivery system to alter the level of the analyte based on the data obtained using the sensor. (See Abstract) In addition, the analyte monitoring system or a component of the analyte monitoring system may optionally include a processor capable of determining a drug or treatment protocol and/or a drug delivery system. (Page 4; lines 6-9).

		FIG. 25 
Claim 34 (new)	**Claim 77 (new)**	
The device of claim 33, wherein the therapy recommendation comprise at least one of an amount insulin and a time for insulin delivery.	The device of claim 76, wherein the therapy recommendation comprise at least one of an amount insulin and a time for insulin delivery.	By analyzing multiple episodes, the data storage and controller module 258, processing circuit 109, and/or analyzer 152 can predict the coarse of a future episode and provide, for example, a drug administration protocol or administer a drug based on this analysis. (Page 91; lines 22-25).

Claim 35 (new)	Claim 78 (new)	
The device of claim 31, wherein the external device comprises at least one of a pacemaker, an infusion device, and a telemetry device.	The device of claim 74, wherein the external device comprises at least one of a pacemaker, an infusion device, and a telemetry device.	Integration With a Drug Administration System FIG. 25 illustrates a block diagram of a sensor-based drug delivery system 250 according to the present invention. The system may provide a drug to counteract the high or low level of the analyte in response to the signals from one or more sensors 252. Alternatively, the system monitors the drug concentration to ensure that the drug remains within a desired therapeutic range. The drug delivery system includes one or more (and preferably two or more) subcutaneously implanted sensors 252, an on-skin sensor control unit 254, a receiver/display unit 256, a data storage and controller module 258, and a drug administration system 260. In some cases, the receiver/display unit 256, data storage and controller module 258, and drug administration system 260 may be integrated in a single unit. The sensor-based drug delivery system 250 uses data form the one or more sensors 252 to provide necessary input for a control algorithm/mechanism in the data storage and controller module 252 to adjust the administration of drugs. As an example, a glucose sensor could be used to control and adjust the administration of insulin. (Page 89; line 26 to page 90, line 10).

		FIG. 25 
Claim 36 (new)	**Claim 79 (new)**	
The device of claim 14, wherein the computer readable memory further comprises instructions configured to receive and process a therapy recommendation from an external source.	The device of claim 55, wherein the computer readable memory further comprises instructions configured to receive and process a therapy recommendation from an external source.	The receiver/display units 46, 48 may also include a number of optional items. One item is a data storage unit 158. ... The data storage unit 158 may also be activated to store data when a directed by the patient via, for example, the optional input device 162. (Page 86; lines 19-29). The data storage unit 158 may also be configured to store data upon occurrence of a particular event, such as a hyperglycemic or hypoglycemic episode, exercise, eating, etc. The storage unit 158 may also store event markers with the data of the particular event. These event markers may be generated either automatically by the display/receiver unit 46, 48 or through input by the patient. (Page 86, line 29 to page 87, line 5)

Claim 37 (new)	**Claim 80 (new)**	
The device of claim 14, wherein the computer readable memory further comprises instructions configured to receive and process software updates from an external source.	The device of claim 55, wherein the computer readable memory further comprises instructions configured to receive and process software updates from an external source.	Functions of the analyte monitoring system 40 and the sensor control unit 44 may be implemented using either software routines, hardware components, or combinations thereof. (Page 62; lines 15-17). Another optional component for the receiver/display unit 46, 48 is an input device 162, such as a keypad or keyboard. The input device 162 may allow numeric or alphanumeric input. The input device 162 may also include buttons, keys, or the like which initiate functions of and/or provide input to the analyte monitoring device 40. Such functions may include initiating a data transfer. (Page 88; lines 4-8).
Claim 38 (new)	**Claim 81 (new)**	
The device of claim 14, wherein the dimensions of the integrated receiver comprise a length of less than about 15 cm, a width of less than about 10 cm, and a thickness of less than about 3.5 cm.	The device of claim 55, wherein the integrated receiver is adapted to fit on a belt.	One or more receiver/display units 46, 48 may be provided with the analyte monitoring device 40 for easy access to the data generated by the sensor 42 and may, in some embodiments, process the signals from the on-skin sensor control unit 44 to determine the concentration or level of analyte in the subcutaneous tissue. Small receiver/display units 46 may be carried by the patient. These units 46 may be palm-sized and/or may be adapted to fit on a belt or within a bag or purse that the patient carries. One embodiment of the small receiver/display unit 46 has the appearance of a pager, for example, so that the user is not identified as a person using a medical device. (Page 79; lines 5-12).
Claim 39 (new)	**Claim 82 (new)**	
The device of claim 14, wherein a volume of the integrated receiver is less than about 180 cm^3.	The device of claim 55, wherein the integrated receiver is the size of a pager.	One or more receiver/display units 46, 48 may be provided with the analyte monitoring device 40 for easy access to the data generated by the sensor 42 and may, in some embodiments, process the signals from the on-skin sensor control unit 44 to determine the concentration or level of analyte in the

		subcutaneous tissue. Small receiver/display units 46 may be carried by the patient. These units 46 may be palm-sized and/or may be adapted to fit on a belt or within a bag or purse that the patient carries. One embodiment of the small receiver/display unit 46 has the appearance of a pager, for example, so that the user is not identified as a person using a medical device. (Page 79; lines 5-12).
Claim 40 (new)	**Claim 83 (new)**	
The device of claim 14, wherein a weight of the integrated receiver is less than about 130 g.	The device of claim 55, wherein the integrated receiver is a bedside unit.	Large receiver/display units 48 may also be used. These larger units 48 may be designed to sit on a shelf or nightstand. (Page 79; ll. 15-16).
Claim 41 (new)	**Claim 84 (new)**	
The device of claim 14, wherein the integrated receiver comprises a cell phone.	The device of claim 55, wherein the integrated receiver comprises a cell phone.	One or more receiver/display units 46, 48 may be provided with the analyte monitoring device 40 for easy access to the data generated by the sensor 42. Small receiver/display units 46 may be carried by the patient. These units 46 may be palm-sized and/or may be adapted to fit on a belt or within a bag or purse that the patient carries. One embodiment of the small receiver/display unit 46 has the appearance of a pager, for example, so that the user is not identified as a person using a medical device. (Page 79; lines 5-12). The analyte monitoring system also includes a sensor that has at least one working electrode and at least one contact pad coupled to the working electrode or electrodes. The analyte monitoring system also includes a display unit that has a receiver for receiving data from the sensor control unit and a display coupled

		to the receiver for displaying an indication of the level of an analyte. The display unit may optionally include a variety of components, such as, for example, a transmitter, an analyzer, a data storage unit, a watchdog circuit, an input device, a power supply, a clock, a lamp, a pager, **a telephone interface**, a computer interface, an alarm or alarm system, a radio, and a calibration unit.
Claim 42 Independent (new)	**Claim 85 Independent (new)**	
A computer system suitable for processing analyte data, the computer system comprising:	A computer system suitable for processing analyte data, the computer system comprising:	The present invention relates to devices and methods for the in vivo monitoring of an analyte using an electrochemical sensor to provide information to a patient about the level of the analyte. (Field of Invention).
a sensor data module configured to receive sensor data, the sensor data comprising a data stream comprising a plurality of time spaced sensor data points from a substantially continuous analyze sensor;	a sensor data module configured to receive sensor data, the sensor data comprising a data stream comprising a plurality of time spaced sensor data points from a substantially continuous analyze sensor;	The on-skin sensor control unit 44 also typically includes at least a portion of the electronic components that operate the sensor 42 and the analyte monitoring device system 40. One embodiment of the electronics in the on-skin control unit 44 is illustrated as a block diagram in FIG. 18A. The electronic components of the on-skin sensor control unit 44 typically include a power supply 95 for operating the on-skin control unit 44 and the sensor 42, **a sensor circuit 97 for obtaining signals from and operating the sensor 42**, a measurement circuit 96 that converts sensor signals to a desired format, and **a processing circuit 109 that, at minimum, obtains signals from the sensor circuit 97** and/or measurement circuit 96 and provides the signals to an optional transmitter 98. (Pages 60-61; lines 27-30 and 1-8). The processing circuit 109 may have one or more of the following functions: ... 5) determine a level of an analyte in the interstitial fluid, 6) determine a level of an analyte in the

		bloodstream based on the sensor signals obtained from interstitial fluid, 7) determine if the level, rate of change, and/or acceleration in the rate of change of the analyte exceeds or meets one or more threshold values. (Page 66; lines 10-12 and 18-21). Additionally: Typically, **data is transmitted to the receiver/display unit 46, 48 at least every hour, preferably, at least every fifteen minutes, more preferably, at least every five minutes, and most preferably, at least every one minute**. (Page 71; lines 17-19).
a reference input module configured to receive reference data from a reference analyte monitor, the reference data comprising at least one reference data point; and	a reference input module configured to receive reference data from a reference analyte monitor, the reference data comprising at least one reference data point; and	In some embodiments, the analyte monitoring system 40 **includes two or more working electrodes 58 distributed over one or more sensors 42**. These working electrodes 58 may be used for quality control purposes. For example, the **output signals and/or analyzed data derived using the two or more working electrodes 58 may be compared to determine if the signals from the working electrodes agree within a desired level of tolerance.** (Page 65; lines 3-8). One embodiment is a method of calibrating an electrochemical sensor having one or more working electrodes implanted in a patient. **A signal is generated from each of the working electrodes**. Several conditions are tested to determine if calibration is appropriate. (Page 5; lines 5-8). In another embodiment, calibration data may be obtained in a variety of ways. For instance, the calibration data may simply be factory-determined calibration measurements which can be input into the on-skin sensor control unit 44 using the receiver 99 or may alternatively be stored in a calibration data storage unit 100

		within the on-skin sensor control unit 44 itself (in which case a receiver 99 may not be needed). The calibration data storage unit 100 may be, for example, a readable or readable/writeable memory circuit. (Page 72; Lines 7-13) Alternative or additional calibration data may be provided based on tests performed by a doctor or some other professional or by the patient himself. For example, **it is common for diabetic individuals to determine their own blood glucose concentration using commercially available testing kits.** The results of this test is input into the on-skin sensor control unit 44 either directly. (Page 72; lines 14-18).
a processor module configured to calibrate the data stream based at least in part on the at least one reference data point,	a processor module configured to calibrate the data stream based at least in part on the at least one reference data point,	These working electrodes 58 may be used for quality control purposes. For example, the **output signals and/or analyzed data derived using the two or more working electrodes 58 may be compared to determine if the signals from the working electrodes agree within a desired level of tolerance.** If the output signals do not agree, then the patient may be alerted to replace the sensor or sensors. The comparison of the two signals may be made for each measurement or at regular intervals. Alternatively or additionally, the comparison may be initiated by the patient or another person. Moreover, the signals from both sensors may be used to generate data or one signal may be discarded after the comparison. (Page 65; lines 4-14). The processing circuit 109 may also incorporate calibration data which has been received from an external source or has been incorporated into the processing circuit 109, both of which are described below, to correct the signal or analyzed data from the working electrode 58. (Page 67, lines 21-24).

wherein the processor module is further configured to determine a rate of change of the calibrated data stream, and	wherein the processor module is further configured to determine a rate of change of the calibrated data stream, and	**The processing circuit 109 may have one or more of the following functions**: **7) determine if the level, rate of change, and/or acceleration in the rate of change of the analyte exceeds or meets one or more threshold values**, (Page 66; lines 10-11 and 18-21).
wherein the processor module is further configured not to calibrate the data stream using reference data obtained during a time when the rate of change of the calibrated data stream is above a threshold.	wherein the processor module is further configured not to calibrate the data stream using reference data obtained during a time when the rate of change of the previously calibrated data stream is above a threshold.	In some embodiments of the invention, calibration data may be required at periodic intervals, for example, every eight hours, once a day, or once a week, to confirm that accurate analyte levels are being reported. (Page 72, lines 26-28). Calibration may also be required each time ... t**he rate of change in the sensor signal exceeds a threshold value**. (Page 72, line 28 through page 73, line 2). The processing circuit 109 or an analyzer 152 may also request another calibration point if the values determined using the sensor data before and after the latest calibration disagree by more than a threshold amount, indicating that the calibration may be incorrect or that the **sensor characteristics have changed radically between calibrations.** This additional calibration point may indicate the source of the difference. (page 74; lines 4-9).
NO CORRESPONDING CLAIM	**Claim 86 (new)**	
	The computer system of claim 85, wherein the processor module is further configured to determine a rate of change of the uncalibrated data stream, and wherein the reference input module is	In another embodiment, the on-skin sensor control unit 44 may optionally be configured to not allow calibration or to **reject a calibration point if**, for example, 3) **the rate of change of the uncalibrated signal is above a threshold rate (e.g., 0.25 mg/dL per minute or 0.5 mg/dL per minute or greater**). (Page 73; lines 15-24).

	configured to reject a reference data point obtained when the rate of change of the uncalibrated data stream is above a threshold.	
Claim 43 (new)	**Claim 87 (new)**	
The computer system of claim 42, wherein the reference input module is configured to reject a reference data point obtained when the rate of change of the data stream is above a threshold.	The computer system of claim 85, wherein the reference input module is configured to reject a reference data point obtained when the rate of change of the data stream is above a threshold.	In another embodiment, the on-skin sensor control unit 44 may optionally be configured to not allow calibration or to **reject a calibration point if**, for example, 3) **the rate of change of the uncalibrated signal is above a threshold rate (e.g., 0.25 mg/dL per minute or 0.5 mg/dL per minute or greater**). (Page 73; lines 15-24)
Claim 44 (new)	**Claim 88 (new)**	
The computer system of claim 42, further comprising a data matching module configured to match a reference data point to a sensor data point to form a matched data pair, wherein the reference data point and the sensor data point are obtained at substantially corresponding times, and wherein the rate of change of the data stream is below a threshold at the time the sensor data point is obtained.	The computer system of claim 85, further comprising a data matching module configured to match a reference data point to a sensor data point to form a matched data pair, wherein the reference data point and the sensor data point are obtained at substantially corresponding times, and wherein the rate of change of the data stream is below a threshold at the time the sensor data point is obtained.	Alternative or additional calibration data may be provided based on tests performed by a doctor or some other professional or by the patient himself. For example, it is common for diabetic individuals to determine their own blood glucose concentration using commercially available testing kits. The results of this test is input into the on-skin sensor control unit 44 either directly, if an appropriate input device (e.g., a keypad, an optical signal receiver, or a port for connection to a keypad or computer) is incorporated in the on-skin sensor control unit 44, or indirectly by inputting the calibration data into the receiver/display unit 46, 48 and transmitting the calibration data to the on-skin sensor control unit 44. (Page 72; lines 14-22). In another embodiment, the receiver/display unit 46, 48 is integrated with a calibration unit (not shown). For example, the receiver/display unit 46, 48 may, for example, include a conventional blood glucose monitor. (Page 89; lines 13-15).

		In some embodiments of the invention, calibration data may be required at periodic intervals, for example, every eight hours, once a day, or once a week, to confirm that accurate analyte levels are being reported. **Calibration may also be required each time a new sensor 42 is implanted or if the sensor exceeds a threshold minimum or maximum value** or if the rate of change in the sensor signal exceeds a threshold value. **In some cases, it may be necessary to wait a period of time after the implantation of the sensor 42** before calibrating to allow the sensor 42 to achieve equilibrium. (Page 72; line 26 to Page 73; line 4). The on-skin sensor control unit 44 and/or receiver display/units 46, 48 may also include an auditory or visual indicator to remind the patient that information, such as analyte levels, reported by the analyte monitoring device 40, may not be accurate because a calibration of the sensor 42 has not been performed within the predetermined periodic time interval and/or after implantation of a new sensor 42. (Page 73; lines 9-14). Additionally, analyte levels, reported by the analyte monitoring device 40, may not be accurate because a **calibration of the sensor 42 has not been performed within the predetermined periodic time interval**. (Page 73; lines 11-13). **ALTERNATIVE SUPPORT** Alternatively, the working electrodes 58 may be used for quality control purposes. For example, the **output signals and/or analyzed data derived using the two or more working electrodes 58 may be compared to determine if the signals from the working electrodes agree within a desired level of tolerance.** (Page 65; lines 4-8).

		Typically, the consecutive readings and/or the threshold level are determined such that all expected excursions of the sensor signal are within the desired parameters (i.e., the sensor control unit 44 does not consider true changes in analyte concentration to be a sensor failure). (Page 65; lines 26-29). The comparison of the two signals may be made for each measurement or at regular intervals. (Page 65; lines 11-12).
Claim 45 (new)	**Claim 89 (new)**	
The computer system of claim 42, further comprising a calibration module configured to form calibration information based at least in part on at least one reference data point and at least one sensor data point, wherein the reference data point and the sensor data point are obtained at substantially corresponding times, and wherein the rate of change of the data stream is below a threshold at the time the sensor data point is obtained.	The computer system of claim 85, further comprising a calibration module configured to form calibration information based at least in part on at least one reference data point and at least one sensor data point, wherein the reference data point and the sensor data point are obtained at substantially corresponding times, and wherein the rate of change of the data stream is below a threshold at the time the sensor data point is obtained.	Alternative or additional calibration data may be provided based on tests performed by a doctor or some other professional or by the patient himself. For example, it is common for diabetic individuals to determine their own blood glucose concentration using commercially available testing kits. The results of this test is input into the on-skin sensor control unit 44 either directly, if an appropriate input device (e.g., a keypad, an optical signal receiver, or a port for connection to a keypad or computer) is incorporated in the on-skin sensor control unit 44, or indirectly by inputting the calibration data into the receiver/display unit 46, 48 and transmitting the calibration data to the on-skin sensor control unit 44. (Page 72; lines 14-22). In another embodiment, the receiver/display unit 46, 48 is integrated with a calibration unit (not shown). For example, the receiver/display unit 46, 48 may, for example, include a conventional blood glucose monitor. (Page 89; lines 13-15). In some embodiments of the invention, calibration data may be required at periodic intervals, for example, every eight hours, once a day, or once a week, to confirm that accurate analyte levels are being reported. **Calibration may also be required**

		each time a new sensor 42 is implanted or if the sensor exceeds a threshold minimum or maximum value or if the rate of change in the sensor signal exceeds a threshold value. **In some cases, it may be necessary to wait a period of time after the implantation of the sensor 42** before calibrating to allow the sensor 42 to achieve equilibrium. (Page 72; line 26 to Page 73; line 4). The on-skin sensor control unit 44 and/or receiver display/units 46, 48 may also include an auditory or visual indicator to remind the patient that information, such as analyte levels, reported by the analyte monitoring device 40, may not be accurate because a calibration of the sensor 42 has not been performed within the predetermined periodic time interval and/or after implantation of a new sensor 42. (Page 73; lines 9-14). **The processing circuit 109 of the on-skin sensor control unit 44 and/or an analyzer 152 of the receiver/display unit 46, 48 may determine when calibration data is needed** and if the calibration data is acceptable. **The on-skin sensor control unit 44 may** optionally be configured to not allow calibration or to reject a calibration point if, for example ... 2) **two or more working electrodes 58 provide uncalibrated signals that are not within a predetermined range** (e.g., within 10% or 20%) of each other; 3) **the rate of change of the uncalibrated signal is above a threshold rate** (e.g., 0.25 mg/dL per minute or 0.5 mg/dL per minute or greater); 4) the uncalibrated signal exceeds a threshold maximum value (e.g., 5, 10, 20, or 40 nA) or is below a threshold minimum value (e.g., 0.05, 0.2, 0.5, or 1 nA) (Page 73; lines 15-27). Alternatively, the working electrodes 58 may be used for quality

		control purposes. For example, the **output signals and/or analyzed data derived using the two or more working electrodes 58 may be compared to determine if the signals from the working electrodes agree within a desired level of tolerance.** (Page 65; lines 4-8).
Claim 46 (new)	**Claim 90 (new)**	
The computer system of claim 42, further comprising a conversion function module configured to create a conversion function based at least in part on at least one sensor data point, wherein the sensor data point is obtained when the rate of change of the data stream is below a threshold, and wherein the conversion function is configured to convert the sensor data point into a calibrated data point.	The computer system of claim 85, further comprising a conversion function module configured to create a conversion function based at least in part on at least one sensor data point, wherein the sensor data point is obtained when the rate of change of the data stream is below a threshold, and wherein the conversion function is configured to convert the sensor data point into a calibrated data point.	**The processing circuit 109 of the on-skin sensor control unit 44 and/or an analyzer 152 of the receiver/display unit 46, 48 may determine when calibration data is needed** and if the calibration data is acceptable. **The on-skin sensor control unit 44 may** optionally be configured to not allow calibration or to reject a calibration point if, for example ... 2) **two or more working electrodes 58 provide uncalibrated signals that are not within a predetermined range** (e.g., within 10% or 20%) of each other; 3) **the rate of change of the uncalibrated signal is above a threshold rate** (e.g., 0.25 mg/dL per minute or 0.5 mg/dL per minute or greater); 4) the uncalibrated signal exceeds a threshold maximum value (e.g., 5, 10, 20, or 40 nA) or is below a threshold minimum value (e.g., 0.05, 0.2, 0.5, or 1 nA) (Page 73; lines 15-27). The processing circuit 109 may have one or more of the following functions: ... 3) convert the information-carrying characteristic of the signals from one characteristic to another (when, for example, that has not been done by the measurement circuit 96), using, for example, a current-to-voltage converter, a current-to-frequency converter, or a voltage-to-current converter, 4) **modify the signals from the sensor circuit 97 using calibration data** and/or output from the temperature probe circuit 99, 5) determine a level of an analyte in the interstitial fluid, 6) determine a level of an analyte in the bloodstream based on the

		sensor signals obtained from interstitial fluid, 7) **determine if the level, rate of change, and/or acceleration in the rate of change of the analyte exceeds or meets one or more threshold values,** 8) activate an alarm if a threshold value is met or exceeded, 9) evaluate trends in the level of an analyte based on a series of sensor signals (Page 66; lines 10-23). **The processing circuit 109 may also incorporate calibration data** which has been received from an external source or has been incorporated into the processing circuit 109, both of which are described below, **to correct** the signal **or analyzed data from the working electrode 58**. (Page 67; lines 17-24). Additionally, as shown in FIG. 24, the sensor data is displayed s a graph, thus requiring certain conversion functions, depending on the desired graphical output.
Claim 47 (new)	**Claim 91 (new)**	
The computer system of claim 42, further comprising a sensor data transformation module configured to convert at least one sensor data point into a calibrated data point, wherein the rate of change of the data stream at the time at which the sensor data point is obtained is below a threshold.	The computer system of claim 85, further comprising a sensor data transformation module configured to convert at least one sensor data point into a calibrated data point, wherein the rate of change of the data stream at the time at which the sensor data point is obtained is below a threshold.	**The processing circuit 109 may also incorporate calibration data** which has been received from an external source or has been incorporated into the processing circuit 109, both of which are described below, **to correct** the signal **or analyzed data from the working electrode 58**. (Page 67; lines 17-24). **The processing circuit 109 of the on-skin sensor control unit 44 and/or an analyzer 152 of the receiver/display unit 46, 48 may determine when calibration data is needed** and if the calibration data is acceptable. **The on-skin sensor control unit 44 may** optionally be configured to not allow calibration or to reject a calibration point if, for example, ... 3) **the rate of change**

		of the uncalibrated signal is above a threshold rate (e.g., 0.25 mg/dL per minute or 0.5 mg/dL per minute or greater); 4) the uncalibrated signal exceeds a threshold maximum value (e.g., 5, 10, 20, or 40 nA) or is below a threshold minimum value (e.g., 0.05, 0.2, 0.5, or 1 nA). (Page 73; lines 15-27).
Claim 48 (new)	**Claim 92 (new)**	
The computer system of claim 42, further comprising: a calibration module configured to form a calibration set based at least in part on at least one matched data pair, the matched data pair comprising a reference data point and a sensor data point, wherein the reference data point and the sensor data point are obtained at substantially corresponding times; and	The computer system of claim 85, further comprising: a calibration module configured to form a calibration set based at least in part on at least one matched data pair, the matched data pair comprising a reference data point and a sensor data point, wherein the reference data point and the sensor data point are obtained at substantially corresponding times; and	Alternative or additional calibration data may be provided based on tests performed by a doctor or some other professional or by the patient himself. For example, it is common for diabetic individuals to determine their own blood glucose concentration using commercially available testing kits. The results of this test is input into the on-skin sensor control unit 44 either directly, if an appropriate input device (e.g., a keypad, an optical signal receiver, or a port for connection to a keypad or computer) is incorporated in the on-skin sensor control unit 44, or indirectly by inputting the calibration data into the receiver/display unit 46, 48 and transmitting the calibration data to the on-skin sensor control unit 44. (Page 72; lines 14-22). In another embodiment, the receiver/display unit 46, 48 is integrated with a calibration unit (not shown). For example, the receiver/display unit 46, 48 may, for example, include a conventional blood glucose monitor. (Page 89; lines 13-15). In some embodiments of the invention, calibration data may be required at periodic intervals, for example, every eight hours, once a day, or once a week, to confirm that accurate analyte levels are being reported. **Calibration may also be required each time a new sensor 42 is implanted or if the sensor exceeds a threshold minimum or maximum value** or if the rate of change in the sensor signal exceeds a threshold value. **In some cases, it may be necessary to wait a period of time after the implantation of the sensor 42** before calibrating to allow the

		sensor 42 to achieve equilibrium. (Page 72; line 26 to Page 73; line 4). The on-skin sensor control unit 44 and/or receiver display/units 46, 48 may also include an auditory or visual indicator to remind the patient that information, such as analyte levels, reported by the analyte monitoring device 40, may not be accurate because a calibration of the sensor 42 has not been performed within the predetermined periodic time interval and/or after implantation of a new sensor 42. (Page 73; lines 9-14). Alternatively, the working electrodes 58 may be used for quality control purposes. For example, the **output signals and/or analyzed data derived using the two or more working electrodes 58 may be compared to determine if the signals from the working electrodes agree within a desired level of tolerance.** (Page 65; lines 4-8). The processing circuit 109 may have one or more of the following functions: ... 7) **determine if the level, rate of change, and/or acceleration in the rate of change of the analyte exceeds or meets one or more threshold values**. (Page 66; lines 10-12 and 19-21). The comparison of the two signals may be made for each measurement or at regular intervals. (Page 65; lines 11-12). **The processing circuit 109 may also incorporate calibration data** which has been received from an external source or has been incorporated into the processing circuit 109, both of which are described below, **to correct** the signal **or analyzed data from the working electrode 58**.

		(Page 67; lines 21-24). Additionally, analyte levels, reported by the analyte monitoring device 40, may not be accurate because a **calibration of the sensor 42 has not been performed within the predetermined periodic time interval**. (Page 73; lines 11-13).
a calibration evaluation module configured to evaluate the matched pair, wherein the calibration evaluation module is configured to prevent the matched data pair from influencing the calibration set if the rate of change of the data stream at the time the sensor data point is obtained is above a threshold.	a calibration evaluation module configured to evaluate the matched pair, wherein the calibration evaluation module is configured to prevent the matched data pair from influencing the calibration set if the rate of change of the data stream at the time the sensor data point is obtained is above a threshold.	**The processing circuit 109 of the on-skin sensor control unit 44 and/or an analyzer 152 of the receiver/display unit 46, 48 may determine** when calibration data is needed and **if the calibration data is acceptable**. The on-skin sensor control unit 44 **may optionally be configured to not allow calibration** or to reject a calibration point if, for example, ... 3) **the rate of change of the uncalibrated signal is above a threshold rate.** (Page 73; lines 15-24).
Claim 49 (new)	**Claim 93 (new)**	
The computer system of claim 42, further comprising a clinical module configured to compare a first reference data point to a second reference data point to determine whether the first reference data point is clinically acceptable, wherein the second reference data point is obtained prior to obtaining the first reference data point, and	The computer system of claim 85, further comprising a clinical module configured to compare a first reference data point to a second reference data point to determine whether the first reference data point is clinically acceptable, wherein the second reference data point is obtained prior to obtaining the first reference data point, and	The working electrodes 58 may be used for quality control purposes. For example, the **output signals and/or analyzed data derived using the two or more working electrodes 58 may be compared to determine if the signals from the working electrodes agree within a desired level of tolerance.** (Page 65; lines 4-8). An example of using signals from only one working electrode for quality control includes comparing consecutive readings obtained using the single working electrode to determine if they differ by more than a threshold level. (Page 65; lines 21-23).

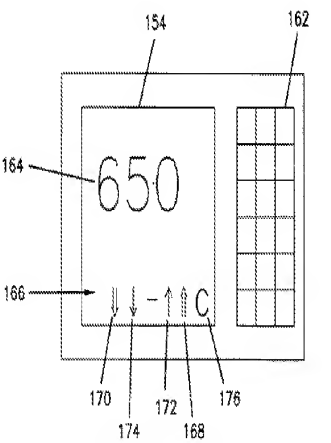
wherein the first reference data point is determined to be clinically acceptable if the difference between the first reference data point and the second reference data point is below a threshold.	wherein the first reference data point is determined to be clinically acceptable if the difference between the first reference data point and the second reference data point is below a threshold.	The processing circuit 109 may have one or more of the following functions: ... 7) **determine if the level, rate of change, and/or acceleration in the rate of change of the analyte exceeds or meets one or more threshold values**. (Page 66; lines 10-12 and 19-21).
Claim 50 (new)	**Claim 94 (new)**	
The computer system of claim 42, further comprising a clinical module configured to compare a first sensor data point to a second sensor data point to determine whether the first sensor data point is clinically acceptable, wherein the second sensor data point is obtained prior to obtaining the first sensor data point, and wherein the first sensor data point is determined to be clinically acceptable if the difference between the first sensor data point and the second sensor data point is below a threshold.	The computer system of claim 85, further comprising a clinical module configured to compare a first sensor data point to a second sensor data point to determine whether the first sensor data point is clinically acceptable, wherein the second sensor data point is obtained prior to obtaining the first sensor data point, and wherein the first sensor data point is determined to be clinically acceptable if the difference between the first sensor data point and the second sensor data point is below a threshold.	The working electrodes 58 may be used for quality control purposes. For example, the **output signals and/or analyzed data derived using the two or more working electrodes 58 may be compared to determine if the signals from the working electrodes agree within a desired level of tolerance.** (Page 65; lines 4-8). An example of using signals from only one working electrode for quality control includes **comparing consecutive readings** obtained using the single working electrode to determine if they differ by more than a threshold level. (Page 65; lines 21-23). The processing circuit 109 may have one or more of the following functions: ... 7) **determine if the level, rate of change, and/or acceleration in the rate of change of the analyte exceeds or meets one or more threshold values**. (Page 66; lines 10-12 and 19-12).

Claim 51 (new)	**Claim 95 (new)**	
The computer system of claim 42, further comprising a stability module configured to determine whether the sensor data is stable, wherein the sensor data is determined to be stable if the rate of change of the data stream is below a threshold at the time the sensor data is obtained.	The computer system of claim 85, further comprising a stability module configured to determine whether the sensor data is stable, wherein the sensor data is determined to be stable if the rate of change of the data stream is below a threshold at the time the sensor data is obtained.	The processing circuit 109 may have one or more of the following functions: ... 7) **determine if the level, rate of change, and/or acceleration in the rate of change of the analyte exceeds or meets one or more threshold values**. (Page 66; lines 10-12 and 19-21).
Claims 52 and 53 (new)	**Claim 96 (new)**	
Claim 52: The computer system of claim 51, wherein the analyte comprises glucose, wherein the data stream comprises measurements indicative of in vivo glucose concentration, and wherein the threshold is at least about 2 mg/dL/min. Claim 53: The computer system of claim 52, wherein the analyte comprises glucose, wherein the data stream comprises measurements indicative of in vivo glucose concentration, and wherein the threshold is at least about 4 mg/dL/min.	The computer system of claim 95, wherein the analyte comprises glucose, wherein the data stream comprises measurements indicative of in vivo glucose concentration, and wherein **the threshold is set at a predetermined level.**	The present invention relates to devices and methods for the **in vivo monitoring of an analyte** using an electrochemical sensor to provide information to a patient about the level of the analyte. (Field of Invention) The on-skin sensor control unit 44 may optionally be configured to not allow calibration or to reject a calibration point if, for example ... 3) **the rate of change of the uncalibrated signal is above a threshold rate** (e.g., 0.25 mg/dL per minute or 0.5 mg/dL per minute or greater). (Page 73; lines 15-25).

	Claim 97 (new)	
	The computer system of claim 96, wherein the analyte comprises glucose, wherein the data stream comprises measurements indicative of in vivo glucose concentration, and wherein the threshold is 0.25 mg/dL/min.	The on-skin sensor control unit 44 may optionally be configured to not allow calibration or to reject a calibration point if, for example ... 3) the rate of change of the uncalibrated signal is above a threshold rate (e.g., **0.25 mg/dL per minute** or 0.5 mg/dL per minute or greater). (Page 73; lines 15-25).
	Claim 98 (new)	
	The computer system of claim 96, wherein the analyte comprises glucose, wherein the data stream comprises measurements indicative of in vivo glucose concentration, and wherein the threshold is 0.5 mg/dL/min.	The on-skin sensor control unit 44 may optionally be configured to not allow calibration or to reject a calibration point if, for example ... 3) the rate of change of the uncalibrated signal is above a threshold rate (e.g., 0.25 mg/dL per minute or **0.5 mg/dL per minute** or greater). (Page 73; lines 15-25).
	Claim 99 (new)	
	The computer system of claim 96, wherein the analyte comprises glucose, wherein the data stream comprises measurements indicative of in vivo glucose concentration, and wherein the threshold is greater than 0.5 mg/dL/min.	The on-skin sensor control unit 44 may optionally be configured to not allow calibration or to reject a calibration point if, for example ... 3) the rate of change of the uncalibrated signal is above a threshold rate (e.g., 0.25 mg/dL per minute or 0.5 mg/dL per minute **or greater**). (Page 73; lines 15-25).
Claim 54 (new)	**Claim 100 (new)**	
The computer system of claim 42, further comprising a user interface, wherein the user interface is configured to request additional reference data when the rate of change of the data stream is below a threshold.	The computer system of claim 85, further comprising a user interface, wherein the user interface is configured to request additional reference data when the rate of change of the data stream is below a threshold.	The processing circuit 109 or an analyzer 152 **may also request another calibration point if the values determined using the sensor data before and after the latest calibration disagree by more than a threshold amount**, indicating that the calibration may be incorrect or that the sensor characteristics have changed radically between calibrations. This additional calibration point may indicate the source of the difference. (Page 74; lines 4-9).

		Calibration may also be required each time a new sensor 42 is implanted or if the sensor exceeds a threshold minimum or maximum value or if the rate of change in the sensor signal exceeds a threshold value. (page 72; line 28 to Page 73; line 2). Another optional component for the receiver/display unit 46, 48 is an input device 162, such as a keypad or keyboard. The input device 162 may allow numeric or alphanumeric input. The input device 162 may also include buttons, keys, or the like which initiate functions of and/or provide input to the analyte monitoring device 40. Such functions may include ... inputting calibration data, and/or indicating events to activate storage of data representative of the event. (Page 88; lines 4-11).
Claim 55 (Independent) (new)	**Claim 101 (Independent) (new)**	
A computer system suitable for processing analyte data, the computer system comprising:	A computer system suitable for processing analyte data, the computer system comprising:	The present invention relates to devices and methods for the in vivo monitoring of an analyte using an electrochemical sensor to provide information to a patient about the level of the analyte. (Field of Invention).
a sensor data module configured to receive sensor data indicative of analyte concentration, the sensor data comprising a data stream comprising a plurality of time spaced sensor data points from a substantially continuous analyte sensor; and	a sensor data module configured to receive sensor data indicative of analyte concentration, the sensor data comprising a data stream comprising a plurality of time spaced sensor data points from a substantially continuous analyte sensor; and	One or more receiver/display units 46, 48 may be provided with the analyte monitoring device 40 for easy access to the data generated by the sensor 42 and may, in some embodiments, process the signals from the on-skin sensor control unit 44 to determine the concentration or level of analyte in the subcutaneous tissue. (Page 79; lines 5-8). Additionally: Typically, **data is transmitted to the receiver/display unit 46, 48 at least every hour, preferably, at least every fifteen minutes, more preferably, at least every five minutes, and most preferably, at least every one minute**.

		(Page 71; lines 17-19).
a processor module configured to calculate a rate of change value associated with a rate of change of the analyte concentration,	a processor module configured to calculate a rate of change value associated with a rate of change of the analyte concentration,	The analyzer 152 may have a variety of functions, similar to the processor circuit 109 of the on-skin sensor control unit 44, including ... 4) determining if the level, rate of change, and/or acceleration in the rate of change of the analyte exceeds or meets one or more threshold values. (Page 83; lines 6-18).
and wherein the processor module is further configured to substantially continuously display, on a user interface, a directional arrow representative of the calculated rate of change value.	and wherein the processor module is further configured to substantially continuously display, on a user interface, a directional arrow representative of the calculated rate of change value.	The output from the analyzer 152 is typically provided to a display 154. (Page 83; line 19). One example of a receiver/display unit 46, 48 is illustrated in FIG. 23. The display 154 of this particular receiver/display unit 46, 48 includes a portion 164 which displays the level of the analyte, for example, the blood glucose concentration, as determined by the processing circuit 109 and/or the analyzer 152 using signals from the sensor 42. (Page 84; lines 4-8). Examples of other graphs that may be useful include graphs of the rate of change or acceleration in the rate of change of the analyte level over time. (See FIG. 24 and corresponding description in (Page 84; lines 17-18). In some embodiments, the receiver/display unit is configured so that the patient may choose the particular display (e.g., blood glucose concentration or graph of concentration versus time) that the patient wishes to view. The patient may choose the desired display mode by pushing a button or the like, for example, on an optional input device 162. One example of a receiver/display unit 46, 48 is illustrated in

		FIG. 23. The display 154 of this particular receiver/display unit 46, 48 includes a portion 164 which displays the level of the analyte, for example, the blood glucose concentration, as determined by the processing circuit 109 and/or the analyzer 152 using signals from the sensor 42. The display also includes various indicators 166 which may be activated under certain conditions. For example, the indicator 168 of a glucose monitoring device may be activated if the patient is hyperglycemic. Other indicators may be activated in the cases of hypoglycemia (170), impending hyperglycemia (172), impending hypoglycemia (174), a malfunction, an error condition, or when a calibration sample is needed (176). (Page 84; lines 4-13). FIG. 23 is reproduced below: FIG. 23 

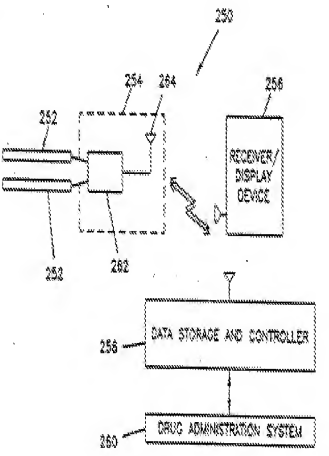
Claim 56 (new)	**Claim 102 (new)**	
The computer system of claim 55, wherein the processor module is further configured to trigger an alarm in response to detection of at least one of hypoglycemia, predicted hypoglycemia, present hypergylcemia and predicted hypoglycemia.	The computer system of claim 101, wherein the processor module is further configured to trigger an alarm in response to detection of at least one of hypoglycemia, predicted hypoglycemia, present ~~hypergylcemia~~ hyperglycemia and predicted ~~hypoglycemia~~ hyperglycemia.	The receiver/display units 46, 48 also typically include an alarm system 156. The options for configuration of the alarm system 156 are similar to those for the alarm system 104 of the on-skin sensor control unit 44. For example, if glucose is the analyte, than the on-skin sensor control unit 44 may include an alarm system 156 that warns the patient of conditions such as hypoglycemia, hyperglycemia, impending hypoglycemia, and/or impending hyperglycemia. (Page 84 line 25 through page 85, line 1).
Claim 57 (new)	**Claim 103 (new)**	
The computer system of claim 56, wherein the alarm comprises at least two of an audible alarm, a tactile alarm and a displayed alarm.	The computer system of claim 102, wherein the alarm comprises at least two of an audible alarm, a tactile alarm and a displayed alarm.	The alarm system 156 may contain one or more individual alarms. Each of the alarms may be individually activated to indicate one or more conditions of the analyte. The alarms may be, for example, auditory or visual. Other sensory-stimulating alarm systems by be used including alarm systems 156 that direct the on-skin sensor control unit 44 to heat, cool, vibrate, or produce a mild electrical shock. (Page 85; lines 21-25).
Claim 58 (new)	**Claim 104 (new)**	
The computer system of claim 55, further comprising an input module configured to receive user information selected from the group consisting of mealtime information, exercise information, insulin administration, customized therapy recommendations and reference analyte values, wherein the processor module is further configured to display, on	The computer system of claim 101, further comprising an input module configured to receive user information selected from the group consisting of mealtime information, exercise information, insulin administration, customized therapy recommendations and reference analyte values, wherein the processor module is further configured to display, on the user interface, the received user	The data storage unit 158 may also be configured to store data upon occurrence of a particular event, such as a hyperglycemic or hypoglycemic episode, exercise, eating, etc. The storage unit 158 may also store event markers with the data of the particular event. These event markers may be generated either automatically by the display/receiver unit 46, 48 or through input by the patient. (Page 86, line 29 through page 87, line 5).

the user interface, the received user information.	information.	
Claim 59 (new)	**Claim 105 (new)**	
The computer system of claim 55, further comprising a reference input module configured to receive reference data from a reference analyte monitor, the reference data comprising at least one reference data point, wherein the processor module is further configured to display, on the user interface, reference outlier values.	The computer system of claim 101, further comprising a reference input module configured to receive reference data from a reference analyte monitor, the reference data comprising at least one reference data point, wherein the processor module is further configured to display, on the user interface, reference outlier values.	In another embodiment, the receiver/display unit 46, 48 is integrated with a calibration unit (not shown). For example, the receiver/display unit 46, 48 may, for example, include a conventional blood glucose monitor. Another useful calibration device utilizing electrochemical detection of analyte concentration is described in U.S. patent application Ser. No. 08/795,767, incorporated herein by reference. Other devices may be used including those that operate using, for example, electrochemical and colorimetric blood glucose assays, assays of interstitial or dermal fluid, and/or non-invasive optical assays. When a calibration of the implanted sensor is needed, the patient uses the integrated in vitro monitor to **generate a reading**. (Page 89; lines 8-23). The processing circuit 109 of the on-skin sensor control unit 44 and/or an analyzer 152 of the receiver/display unit 46, 48 may determine when calibration data is needed and if the calibration data is acceptable. (Page 73; lines 15-17).
Claim 60 (new)	**Claim 106 (new)**	
The computer system of claim 55, further comprising a reference input module configured to receive reference data from a reference analyte monitor, the reference data comprising at least one reference data point, wherein the processor module is further	The computer system of claim 101, further comprising a reference input module configured to receive reference data from a reference analyte monitor, the reference data comprising at least one reference data point, wherein the processor module is further configured to request, on the user interface,	Alternative or additional calibration data may be provided based on tests performed by a doctor or some other professional or by the patient himself. For example, it is common for diabetic individuals to determine their own blood glucose concentration using commercially available testing kits. The results of this test is input into the on-skin sensor control unit 44 either directly, if an appropriate input device (e.g., a keypad, an optical signal receiver, or a port for connection to a keypad or computer) is incorporated in the on-skin sensor control unit 44, or indirectly by

configured to request, on the user interface, reference analyte values.	reference analyte values.	inputting the calibration data into the receiver/display unit 46, 48 and transmitting the calibration data to the on-skin sensor control unit 44. (Page 72; lines 14-22). The processing circuit 109 or an analyzer 152 may also request another calibration point if the values determined using the sensor data before and after the latest calibration disagree by more than a threshold amount, indicating that the calibration may be incorrect or that the sensor characteristics have changed radically between calibrations. (Page 74; lines 4-9).
Claim 61 (new)	**Claim 107 (new)**	
The computer system of claim 55, wherein the processor module is further configured to display, on the user interface, a therapy recommendation.	The computer system of claim 101, wherein the processor module is further configured to display, on the user interface, a therapy recommendation.	In one embodiment, the display 154 also provides a message to the patient to direct the patient in an action. Such messages may include, for example, "Eat Sugar," if the patient is hypoglycemic, or "Take Insulin," if the patient is hyperglycemic. (Page 83, line 29 through page 84, line 3; see also FIGS. 23 and 24)
Claim 62 (new)	**Claim 108 (new)**	
The computer system of claim 55, wherein the processor module is further configured to output data to an external device.	The computer system of claim 101, wherein the processor module is further configured to output data to an external device.	In addition, in some embodiments of the invention, the transmitter 160 may be configured to transmit data to another receiver/display unit 46, 48 or some other receiver. For example, a small receiver/display unit 46 may transmit data to a large receiver/display unit 48, as illustrated in FIG. 1. As another example, a receiver/display unit 46, 48 may transmit data to a computer in the patient's home or at a doctor's office. (Page 87; lines 19-26).

Claim 63 (new)	Claim 109 (new)	
The computer system of claim 62, wherein the data output comprises at least one of an alert, a message, and a warning, and wherein the external device comprises a telecommunications device.	The computer system of claim 108, wherein the data output comprises at least one of an alert, a message, and a warning, and wherein the external device comprises a telecommunications device.	As another example, a receiver/display unit 46, 48 may transmit data to a computer in the patient's home or at a doctor's office. Moreover, the transmitter 160 or a separate transmitter may direct a transmission to another unit or to a telephone or other communications device that alerts a doctor or other individual when an alarm is activated and/or if, after a predetermined time period, an activated alarm has not been deactivated, suggesting that the patient may require assistance. In some embodiments, the receiver/display unit is capable of one-way or two-way paging and/or is coupled to a telephone line to send and/or receive messages from another, such as a health professional monitoring the patient. (Page 87, line 24 through page 88, line 3).
Claim 64 (new)	**Claim 110 (new)**	
The computer system of claim 62, wherein the data output comprises therapy recommendations, and wherein the external device comprises an insulin delivery device.	The computer system of claim 108, wherein the data output comprises therapy recommendations, and wherein the external device comprises an insulin delivery device.	FIG. 25 illustrates a block diagram of a sensor-based drug delivery system 250 according to the present invention. The system may provide a drug to counteract the high or low level of the analyte in response to the signals from one or more sensors 252. (Page 89; lines 26-28). A processor 262 in the on-skin sensor control unit 254, as illustrated in FIG. 25, or in the receiver/display unit 256 determines the level of the analyte, and possibly other information, such as the rate or acceleration of the rate in the increase or decrease in analyte level. This information is then transmitted to the data storage and controller module 252 using a transmitter 264 in the on-skin sensor control unit 254, as illustrated in FIG. 25, or a non-integrated receiver/display unit 256. (Page 90; lines 13-19). In one embodiment, the data storage and controller module 258, processing circuit 109, and/or analyzer 152 utilizes patient-specific data from multiple episodes to predict a patient's

		response to future episodes. (Page 91; lines 14-16). By analyzing multiple episodes, the data storage and controller module 258, processing circuit 109, and/or analyzer 152 can predict the coarse of a future episode and provide, for example, a drug administration protocol or administer a drug based on this analysis. (Page 91; lines 22-25).
Claim 65 (new)	**Claim 111 (new)**	
The computer system of claim 62, wherein the external device comprises at least one of a pacemaker, an infusion device, and a telemetry device.	The computer system of claim 108, wherein the external device comprises at least one of a pacemaker, an infusion device, and a telemetry device.	Integration With a Drug Administration System FIG. 25 illustrates a block diagram of a sensor-based drug delivery system 250 according to the present invention. The system may provide a drug to counteract the high or low level of the analyte in response to the signals from one or more sensors 252. Alternatively, the system monitors the drug concentration to ensure that the drug remains within a desired therapeutic range. The drug delivery system includes one or more (and preferably two or more) subcutaneously implanted sensors 252, an on-skin sensor control unit 254, a receiver/display unit 256, a data storage and controller module 258, and a drug administration system 260. In some cases, the receiver/display unit 256, data storage and controller module 258, and drug administration system 260 may be integrated in a single unit. The sensor-based drug delivery system 250 uses data form the one or more sensors 252 to provide necessary input for a control algorithm/mechanism in the data storage and controller module 252 to adjust the administration of drugs. As an example, a glucose sensor could be used to control and adjust the administration of insulin. (Page 89, line 26 through page 90, line 1).

		FIG. 25 
Claim 66 (new)	**Claim 112 (new)**	
The computer system of claim 55, wherein the processor module is further configured to receive and display a therapy recommendation from an external source.	The computer system of claim 101, wherein the processor module is further configured to receive and display a therapy recommendation from an external source.	The receiver/display units 46, 48 may also include a number of optional items. One item is a data storage unit 158. ... The data storage unit 158 may also be activated to store data when a directed by the patient via, for example, the optional input device 162. (Page 86; lines 19-29). The data storage unit 158 may also be configured to store data upon occurrence of a particular event, such as a hyperglycemic or hypoglycemic episode, exercise, eating, etc. The storage unit 158 may also store event markers with the data of the particular event. These event markers may be generated either automatically by the display/receiver unit 46, 48 or through input by the patient. (Page 86, line 29 to page 87, line 5)

Claim 67 (new)	Claim 113 (new)	
The computer system of claim 55, wherein the processor module is further configured to receive and display a target analyte values from an external source.	The computer system of claim 101, wherein the processor module is further configured to receive and display a target analyte values from an external source.	The alarm system 104 is triggered when the data from the processing circuit 109 reaches or exceeds a threshold value. Examples of threshold values for blood glucose levels are about 60, 70, or 80 mg/dL for hypoglycemia; about 70, 80, or 90 mg/dL for impending hypoglycemia; about 130, 150, 175, 200, 225, 250, or 275 mg/dL for impending hyperglycemia; and about 150, 175, 200, 225, 250, 275, or 300 mg/dL for hyperglycemia. The actual threshold values that are designed into the alarm system 104 may correspond to interstitial fluid glucose concentrations or electrode measurements (e.g., current values or voltage values obtained by conversion of current measurements) that correlate to the above-mentioned blood glucose levels. The analyte monitor device may be configured so that the threshold levels for these or any other conditions may be programmable by the patient and/or a medical professional. (Page 75; ll. 1-11). The receiver/display units 46, 48 also typically include an alarm system 156. The options for configuration of the alarm system 156 are similar to those for the alarm system 104 of the on-skin sensor control unit 44. (Page 84; ll. 25-27). The data received by the receiver 150 of the receiver/display units 46, 48 is then sent to an analyzer 152. The analyzer 152 may have a variety of functions, similar to the processor circuit 109 of the on-skin sensor control unit 44. (Page 83; ll. 5-7). The output from the analyzer 152 is typically provided to a display 154. (Page 83; line 19).

Claim 68 (new)	Claim 114 (new)	
The computer system of claim 55, wherein the processor module is further configured to receive and process software updates from an external source.	The computer system of claim 101, wherein the processor module is further configured to receive and process software updates from an external source.	Functions of the analyte monitoring system 40 and the sensor control unit 44 may be implemented using either software routines, hardware components, or combinations thereof. (Page 62; lines 15-17). Another optional component for the receiver/display unit 46, 48 is an input device 162, such as a keypad or keyboard. The input device 162 may allow numeric or alphanumeric input. The input device 162 may also include buttons, keys, or the like which initiate functions of and/or provide input to the analyte monitoring device 40. Such functions may include initiating a data transfer. (Page 88; lines 4-8).
Claim 69 (new)	**Claim 115 (new)**	
The computer system of claim 55, wherein the processor module is further configured to display, on the user interface, a plurality of activities from which a user can select his or her current activity.	The computer system of claim 101, wherein the processor module is further configured to display, on the user interface, a plurality of activities from which a user can select his or her current activity.	The data storage unit 158 may also be configured to store data upon occurrence of a particular event, such as a hyperglycemic or hypoglycemic episode, exercise, eating, etc. The storage unit 158 may also store event markers with the data of the particular event. These event markers may be generated either automatically by the display/receiver unit 46, 48 or through input by the patient. (Page 86, line 29 through page 87, line 5). The input device 162 may also include buttons, keys, or the like which initiate functions of and/or provide input to the analyte monitoring device 40. Such functions may include initiating a data transfer, manually changing the transmission frequency or frequency band of the transmitter 98, deactivating an alarm system 104, 156, inputting calibration data, and/or indicating events to activate storage of data representative of the event. (Page 88; lines 6-11).

Claim 70 (new)	Claim 116 (new)	
The computer system of claim 55, wherein the processor module is further configured to display, on the user interface, one or more boundaries.	The computer system of claim 101, wherein the processor module is further configured to display, on the user interface, one or more boundaries.	The alarm system 104 is triggered when the data from the processing circuit 109 reaches or exceeds a threshold value. Examples of threshold values for blood glucose levels are about 60, 70, or 80 mg/dL for hypoglycemia; about 70, 80, or 90 mg/dL for impending hypoglycemia; about 130, 150, 175, 200, 225, 250, or 275 mg/dL for impending hyperglycemia; and about 150, 175, 200, 225, 250, 275, or 300 mg/dL for hyperglycemia. The actual threshold values that are designed into the alarm system 104 may correspond to interstitial fluid glucose concentrations or electrode measurements (e.g., current values or voltage values obtained by conversion of current measurements) that correlate to the above-mentioned blood glucose levels. The analyte monitor device may be configured so that the threshold levels for these or any other conditions may be programmable by the patient and/or a medical professional. (Page 75; ll. 1-11). The display also includes various indicators 166 which may be activated under certain conditions. For example, the indicator 168 of a glucose monitoring device may be activated if the patient is hyperglycemic. Other indicators may be activated in the cases of hypoglycemia (170), impending hyperglycemia (172), impending hypoglycemia (174), a malfunction, an error condition, or when a calibration sample is needed (176). In some embodiments, color coded indicators may be used. Alternatively, the portion 164 which displays the blood glucose concentration may also include a composite indicator 180 (see FIG. 24), portions of which may be appropriately activated to indicate any of the conditions described above.

Claim 71 (new)	**Claim 117 (new)**	
The computer system of claim 70, wherein the one or more boundaries comprise upper and lower boundaries.	The computer system of claim 116, wherein the one or more boundaries comprise upper and lower boundaries.	The alarm system 104 is triggered when the data from the processing circuit 109 reaches or exceeds a threshold value. Examples of threshold values for blood glucose levels are about 60, 70, or 80 mg/dL for hypoglycemia; about 70, 80, or 90 mg/dL for impending hypoglycemia; about 130, 150, 175, 200, 225, 250, or 275 mg/dL for impending hyperglycemia; and about 150, 175, 200, 225, 250, 275, or 300 mg/dL for hyperglycemia. (Page 75; ll. 1-6).
Claim 72 (new)	**Claim 118 (new)**	
The computer system of claim 71, wherein the upper and lower boundaries are user selectable.	The computer system of claim 117, wherein the upper and lower boundaries are user selectable.	The alarm system 104 is triggered when the data from the processing circuit 109 reaches or exceeds a threshold value. Examples of threshold values for blood glucose levels are about 60, 70, or 80 mg/dL for hypoglycemia; about 70, 80, or 90 mg/dL for impending hypoglycemia; about 130, 150, 175, 200, 225, 250, or 275 mg/dL for impending hyperglycemia; and about 150, 175, 200, 225, 250, 275, or 300 mg/dL for hyperglycemia. ... The **analyte monitor device may be configured so that the threshold levels for these or any other conditions may be programmable by the patient and/or a medical professional**. (Page 75; ll. 1-11).
Claim 73 (new)	**Claim 119 (new)**	
The computer system of claim 71, wherein the upper and lower boundaries correspond to upper and lower thresholds associated with hypoglycemic and hyperglycemic alarms.	The computer system of claim 117, wherein the upper and lower boundaries correspond to upper and lower thresholds associated with hypoglycemic and hyperglycemic alarms.	The alarm system 104 is triggered when the data from the processing circuit 109 reaches or exceeds a threshold value. Examples of threshold values for blood glucose levels are about 60, 70, or 80 mg/dL for hypoglycemia; about 70, 80, or 90 mg/dL for impending hypoglycemia; about 130, 150, 175, 200, 225, 250, or 275 mg/dL for impending hyperglycemia; and about 150, 175, 200, 225, 250, 275, or 300 mg/dL for hyperglycemia. (Page 75; ll. 1-6).

Claim 74 (new)	**Claim 120 (new)**	
The computer system of claim 55, wherein the processor module is configured to display a graphical representation of analyte concentration over a time period.	The computer system of claim 101, wherein the processor module is configured to display a graphical representation of analyte concentration over a time period.	The display 154 may also be capable of displaying a graph 178 of the analyte level over a period of time, as illustrated in FIG. 24. (Page 84; lines 17-18).
Claim 75 (new)	**Claim 121 (new)**	
The computer system of claim 74, wherein processor module is configured to display the graphical representation for a plurality of user selectable time periods.	The computer system of claim 120, wherein processor module is configured to display the graphical representation for a plurality of user selectable time periods.	The display 154 may also be capable of displaying a graph 178 of the analyte level over a period of time, as illustrated in FIG. 24. Examples of other graphs that may be useful include graphs of the rate of change or acceleration in the rate of change of the analyte level over time. In some embodiments, the receiver/display unit is configured so that the patient may choose the particular display (e.g., blood glucose concentration or graph of concentration versus time) that the patient wishes to view. The patient may choose the desired display mode by pushing a button or the like, for example, on an optional input device 162. (Page 84; lines 17-24).
Claim 76 (Independent)(new)	**Claim 122 (Independent)(new)**	
A computer system suitable for processing analyte data, the computer system comprising:	A computer system suitable for processing analyte data, the computer system comprising:	The present invention relates to devices and methods for the in vivo monitoring of an analyte using an electrochemical sensor to provide information to a patient about the level of the analyte. (Field of Invention).
a sensor data module configured to receive sensor data indicative of an analyte concentration, the	a sensor data module configured to receive sensor data indicative of an analyte concentration, the sensor	One or more receiver/display units 46, 48 may be provided with the analyte monitoring device 40 for easy access to the data generated by the sensor 42 and may, in some embodiments,

sensor data comprising a data stream comprising a plurality of time spaced sensor data points from a substantially continuous analyte sensor; and	data comprising a data stream comprising a plurality of time spaced sensor data points from a substantially continuous analyte sensor; and	process the signals from the on-skin sensor control unit 44 to determine the concentration or level of analyte in the subcutaneous tissue. (Page 79; lines 5-8). Additionally: Typically, **data is transmitted to the receiver/display unit 46, 48 at least every hour, preferably, at least every fifteen minutes, more preferably, at least every five minutes, and most preferably, at least every one minute**. (Page 71; lines 17-19).
a processor module configured to determine a rate of change of the data stream,	a processor module configured to determine a rate of change of the data stream,	The analyzer 152 may have a variety of functions, similar to the processor circuit 109 of the on-skin sensor control unit 44, including ... 4) determining if the level, rate of change, and/or acceleration in the rate of change of the analyte exceeds or meets one or more threshold values. (Page 83; lines 6-18).
and wherein the processor module is further configured to simultaneously display, on a user interface, a numeric analyte concentration, an indication of rate of change of analyte concentration, and a graphical representation of analyte concentration over a period of time.	and wherein the processor module is further configured to ~~simultaneously~~ display, on a user interface, a numeric analyte concentration, an indication of rate of change of analyte concentration, and a graphical representation of analyte concentration over a period of time.	One example of a receiver/display unit 46, 48 is illustrated in FIG. 23. The display 154 of this particular receiver/display unit 46, 48 includes a portion 164 which displays the level of the analyte, for example, the blood glucose concentration, as determined by the processing circuit 109 and/or the analyzer 152 using signals from the sensor 42. The display also includes various indicators 166 which may be activated under certain conditions. For example, the indicator 168 of a glucose monitoring device may be activated if the patient is hyperglycemic. Other indicators may be activated in the cases of hypoglycemia (170), impending hyperglycemia (172), impending hypoglycemia (174), a malfunction, an error condition, or when a calibration sample is needed. (176). (Page 84; lines 4-13). The display 154 may also be capable of displaying a graph 178 of

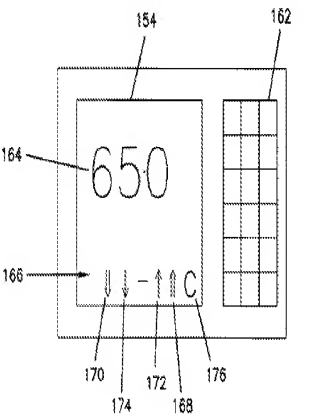
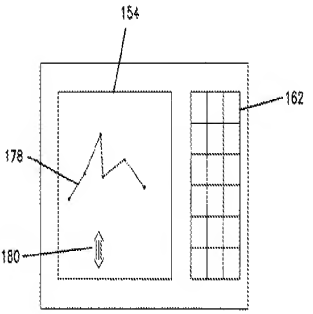
		the analyte level over a period of time, as illustrated in FIG. 24. ...The patient may choose the desired display mode by pushing a button or the like, for example, on an optional input device 162. (Page 84; lines 17-24). See also, FIGS. 23 and 24, provided below. FIG. 23 

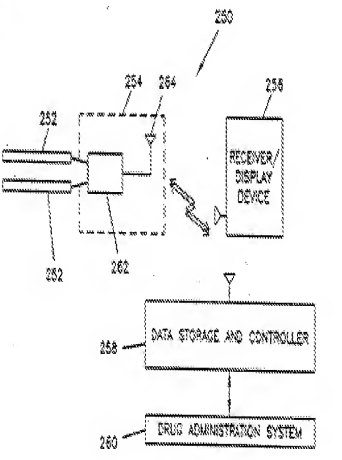
		FIG. 24 
Claim 77 (new)	**Claim 123 (new)**	
The computer system of claim 76, wherein the processor module is further configured to trigger an alarm in response to detection of at least one of hypoglycemia. predicted hypoglycemia, present hypergylcemia and predicted hypoglycemia.	The computer system of claim 122, wherein the processor module is further configured to trigger an alarm in response to detection of at least one of hypoglycemia. predicted hypoglycemia, present ~~hypergylcemia~~ hyperglycemia and predicted ~~hypoglycemia~~ hyperglycemia.	The receiver/display units 46, 48 also typically include an alarm system 156. The options for configuration of the alarm system 156 are similar to those for the alarm system 104 of the on-skin sensor control unit 44. For example, if glucose is the analyte, than the on-skin sensor control unit 44 may include an alarm system 156 that warns the patient of conditions such as hypoglycemia, hyperglycemia, impending hypoglycemia, and/or impending hyperglycemia. (Page 84, line 25 through page 85, line 1).
Claim 78 (new)	**Claim 124 (new)**	
The computer system of claim 77, wherein the alarm comprises at least two of an audible alarm, a tactile alarm and a displayed alarm.	The computer system of claim 123, wherein the alarm comprises at least two of an audible alarm, a tactile alarm and a displayed alarm.	The alarm system 156 may contain one or more individual alarms. Each of the alarms may be individually activated to indicate one or more conditions of the analyte. The alarms may be, for example, auditory or visual. Other sensory-stimulating alarm systems by be used including alarm systems 156 that direct the on-skin sensor control unit 44 to heat, cool, vibrate, or produce a mild electrical shock. (Page 85; lines 21-25).

Claim 79 (new)	**Claim 125 (new)**	
The computer system of claim 76, further comprising an input module configured to receive user information selected from the group consisting of mealtime information, exercise information, insulin administration, customized therapy recommendations and reference analyte values, wherein the processor module is further configured to display, on the user interface, the received user information.	The computer system of claim 122, further comprising an input module configured to receive user information selected from the group consisting of mealtime information, exercise information, insulin administration, customized therapy recommendations and reference analyte values, wherein the processor module is further configured to display, on the user interface, the received user information.	The data storage unit 158 may also be configured to store data upon occurrence of a particular event, such as a hyperglycemic or hypoglycemic episode, exercise, eating, etc. The storage unit 158 may also store event markers with the data of the particular event. These event markers may be generated either automatically by the display/receiver unit 46, 48 or through input by the patient. (Page 86, line 29 through page 87, line 5).
Claim 80 (new)	**Claim 126 (new)**	
The computer system of claim 76, further comprising a reference input module configured to receive reference data from a reference analyte monitor, the reference data comprising at least one reference data point, wherein the processor module is further configured to display, on the user interface. reference outlier values.	The computer system of claim 122, further comprising a reference input module configured to receive reference data from a reference analyte monitor, the reference data comprising at least one reference data point, wherein the processor module is further configured to display, on the user interface. reference outlier values.	In another embodiment, the receiver/display unit 46, 48 is integrated with a calibration unit (not shown). For example, the receiver/display unit 46, 48 may, for example, include a conventional blood glucose monitor. Another useful calibration device utilizing electrochemical detection of analyte concentration is described in U.S. patent application Ser. No. 08/795,767, incorporated herein by reference. Other devices may be used including those that operate using, for example, electrochemical and colorimetric blood glucose assays, assays of interstitial or dermal fluid, and/or non-invasive optical assays. When a calibration of the implanted sensor is needed, the patient uses the integrated in vitro monitor to **generate a reading**. (Page 89; lines 8-23). The processing circuit 109 of the on-skin sensor control unit 44 and/or an analyzer 152 of the receiver/display unit 46, 48 may determine when calibration data is needed and if the calibration

		data is acceptable. (Page 73; lines 15-17).
Claim 81 (new)	**Claim 127 (new)**	
The computer system of claim 76, further comprising a reference input module configured to receive reference data from a reference analyte monitor, the reference data comprising at least one reference data point, wherein the processor module is further configured to request, on the user interface, reference analyte values.	The computer system of claim 122, further comprising a reference input module configured to receive reference data from a reference analyte monitor, the reference data comprising at least one reference data point, wherein the processor module is further configured to request, on the user interface, reference analyte values.	Alternative or additional calibration data may be provided based on tests performed by a doctor or some other professional or by the patient himself. For example, it is common for diabetic individuals to determine their own blood glucose concentration using commercially available testing kits. The results of this test is input into the on-skin sensor control unit 44 either directly, if an appropriate input device (e.g., a keypad, an optical signal receiver, or a port for connection to a keypad or computer) is incorporated in the on-skin sensor control unit 44, or indirectly by inputting the calibration data into the receiver/display unit 46, 48 and transmitting the calibration data to the on-skin sensor control unit 44. (Page 72; lines 14-22). The processing circuit 109 or an analyzer 152 may also request another calibration point if the values determined using the sensor data before and after the latest calibration disagree by more than a threshold amount, indicating that the calibration may be incorrect or that the sensor characteristics have changed radically between calibrations. (Page 74; lines 4-9).
Claim 82 (new)	**Claim 128 (new)**	
The computer system of claim 76, wherein the processor module is further configured to display, on the user interface, a therapy recommendation.	The computer system of claim 122, wherein the processor module is further configured to display, on the user interface, a therapy recommendation.	In one embodiment, the display 154 also provides a message to the patient to direct the patient in an action. Such messages may include, for example, “Eat Sugar,” if the patient is hypoglycemic, or “Take Insulin,” if the patient is hyperglycemic. (Page 83, line 29 through page 84; line 3; see also FIGS. 23 and 24)

Claim 83 (new)	Claim 129 (new)	
The computer system of claim 76, wherein the processor module is further configured to output data to an external device.	The computer system of claim 122, wherein the processor module is further configured to output data to an external device.	In addition, in some embodiments of the invention, the transmitter 160 may be configured to transmit data to another receiver/display unit 46, 48 or some other receiver. For example, a small receiver/display unit 46 may transmit data to a large receiver/display unit 48, as illustrated in FIG. 1. As another example, a receiver/display unit 46, 48 may transmit data to a computer in the patient's home or at a doctor's office. (Page 87, lines 19-26).
Claim 84 (new)	**Claim 130 (new)**	
The computer system of claim 83, wherein the data output comprises at least one of an alert, a message, and a warning, and wherein the external device comprises a telecommunications device.	The computer system of claim 129, wherein the data output comprises at least one of an alert, a message, and a warning, and wherein the external device comprises a telecommunications device.	As another example, a receiver/display unit 46, 48 may transmit data to a computer in the patient's home or at a doctor's office. Moreover, the transmitter 160 or a separate transmitter may direct a transmission to another unit or to a telephone or other communications device that alerts a doctor or other individual when an alarm is activated and/or if, after a predetermined time period, an activated alarm has not been deactivated, suggesting that the patient may require assistance. In some embodiments, the receiver/display unit is capable of one-way or two-way paging and/or is coupled to a telephone line to send and/or receive messages from another, such as a health professional monitoring the patient. (Page 87, line 24 through page 88, line 3).
Claim 85 (new)	**Claim 131 (new)**	
The computer system of claim 83, wherein the data output comprises therapy recommendations, and wherein the external device comprises an insulin delivery device.	The computer system of claim 129, wherein the data output comprises therapy recommendations, and wherein the external device comprises an insulin delivery device.	FIG. 25 illustrates a block diagram of a sensor-based drug delivery system 250 according to the present invention. The system may provide a drug to counteract the high or low level of the analyte in response to the signals from one or more sensors 252. (Page 89; lines 26-28). A processor 262 in the on-skin sensor control unit 254, as illustrated in FIG. 25, or in the receiver/display unit 256

		determines the level of the analyte, and possibly other information, such as the rate or acceleration of the rate in the increase or decrease in analyte level. This information is then transmitted to the data storage and controller module 252 using a transmitter 264 in the on-skin sensor control unit 254, as illustrated in FIG. 25, or a non-integrated receiver/display unit 256. (Page 90; lines 13-19). In one embodiment, the data storage and controller module 258, processing circuit 109, and/or analyzer 152 utilizes patient-specific data from multiple episodes to predict a patient's response to future episodes. (Page 91; lines 14-16) By analyzing multiple episodes, the data storage and controller module 258, processing circuit 109, and/or analyzer 152 can predict the coarse of a future episode and provide, for example, a drug administration protocol or administer a drug based on this analysis. (Page 91; lines 22-25).
Claim 86 (new)	**Claim 132 (new)**	
The computer system of claim 83, wherein the external device comprises at least one of a pacemaker, an infusion device, and a telemetry device.	The computer system of claim 129, wherein the external device comprises at least one of a pacemaker, an infusion device, and a telemetry device.	Integration With a Drug Administration System FIG. 25 illustrates a block diagram of a sensor-based drug delivery system 250 according to the present invention. The system may provide a drug to counteract the high or low level of the analyte in response to the signals from one or more sensors 252. Alternatively, the system monitors the drug concentration to ensure that the drug remains within a desired therapeutic range. The drug delivery system includes one or more (and preferably two or more) subcutaneously implanted sensors 252, an on-skin sensor control unit 254, a receiver/display unit 256, a data storage and controller module 258, and a drug administration system 260. In some cases, the receiver/display unit 256, data storage and

		controller module 258, and drug administration system 260 may be integrated in a single unit. The sensor-based drug delivery system 250 uses data form the one or more sensors 252 to provide necessary input for a control algorithm/mechanism in the data storage and controller module 252 to adjust the administration of drugs. As an example, a glucose sensor could be used to control and adjust the administration of insulin. (Page 89, line 26 through page 90, line 1). FIG. 25 

Claim 87 (new)	**Claim 133 (new)**	
The computer system of claim 76, wherein the processor module is further configured to receive and display a therapy recommendation from an external source.	The computer system of claim 122, wherein the processor module is further configured to receive and display a therapy recommendation from an external source.	The receiver/display units 46, 48 may also include a number of optional items. One item is a data storage unit 158. ... The data storage unit 158 may also be activated to store data when a directed by the patient via, for example, the optional input device 162. (Page 86; lines 19-29). The data storage unit 158 may also be configured to store data upon occurrence of a particular event, such as a hyperglycemic or hypoglycemic episode, exercise, eating, etc. The storage unit 158 may also store event markers with the data of the particular event. These event markers may be generated either automatically by the display/receiver unit 46, 48 or through input by the patient. (Page 86, line 29 to page 87, line 5)
Claim 88 (new)	**Claim 134 (new)**	
The computer system of claim 76, wherein the processor module is further configured to receive and display *a* target analyte values from an external source.	The computer system of claim 122, wherein the processor module is further configured to receive and display a target analyte values from an external source.	The alarm system 104 is triggered when the data from the processing circuit 109 reaches or exceeds a threshold value. Examples of threshold values for blood glucose levels are about 60, 70, or 80 mg/dL for hypoglycemia; about 70, 80, or 90 mg/dL for impending hypoglycemia; about 130, 150, 175, 200, 225, 250, or 275 mg/dL for impending hyperglycemia; and about 150, 175, 200, 225, 250, 275, or 300 mg/dL for hyperglycemia. The actual threshold values that are designed into the alarm system 104 may correspond to interstitial fluid glucose concentrations or electrode measurements (e.g., current values or voltage values obtained by conversion of current measurements) that correlate to the above-mentioned blood glucose levels. The analyte monitor device may be configured so that the threshold levels for these or any other conditions may be programmable by the patient and/or a medical professional. (Page 75; ll. 1-11). The receiver/display units 46, 48 also typically include an alarm system 156. The options for configuration of the alarm system

		156 are similar to those for the alarm system 104 of the on-skin sensor control unit 44. (Page 84; ll. 25-27). The data received by the receiver 150 of the receiver/display units 46, 48 is then sent to an analyzer 152. The analyzer 152 may have a variety of functions, similar to the processor circuit 109 of the on-skin sensor control unit 44. (Page 83; ll. 5-7). The output from the analyzer 152 is typically provided to a display 154. (Page 83; line 19).
Claim 89 (new)	**Claim 135 (new)**	
The computer system of claim 76, wherein the processor module is further configured to receive and software updates from an external source.	The computer system of claim 122, wherein the processor module is further configured to receive and software updates from an external source.	Functions of the analyte monitoring system 40 and the sensor control unit 44 may be implemented using either software routines, hardware components, or combinations thereof. (Page 62; lines 15-17). Another optional component for the receiver/display unit 46, 48 is an input device 162, such as a keypad or keyboard. The input device 162 may allow numeric or alphanumeric input. The input device 162 may also include buttons, keys, or the like which initiate functions of and/or provide input to the analyte monitoring device 40. Such functions may include initiating a data transfer. (Page 88; lines 4-8).
Claim 90 (new)	**Claim 136 (new)**	
The computer system of claim 76, wherein the processor module is further configured to display, on the user interface, a plurality of activities from which a user can select his or her current activity.	The computer system of claim 122, wherein the processor module is further configured to display, on the user interface, a plurality of activities from which a user can select his or her current activity.	The data storage unit 158 may also be configured to store data upon occurrence of a particular event, such as a hyperglycemic or hypoglycemic episode, exercise, eating, etc. The storage unit 158 may also store event markers with the data of the particular event. These event markers may be generated either automatically by the display/receiver unit 46, 48 or through input by the patient. (Page 86, line 29 through page 87, line 5). The input device 162 may also include buttons, keys, or the like which initiate functions of and/or provide input to the analyte monitoring device 40. Such functions may include initiating a

		data transfer, manually changing the transmission frequency or frequency band of the transmitter 98, deactivating an alarm system 104, 156, inputting calibration data, and/or indicating events to activate storage of data representative of the event. (Page 88; lines 6-11).
Claim 91 (new)	**Claim 137 (new)**	
The computer system of claim 76, wherein the processor module is further configured to display, on the user interface, one or more boundaries.	The computer system of claim 122, wherein the processor module is further configured to display, on the user interface, one or more boundaries.	The alarm system 104 is triggered when the data from the processing circuit 109 reaches or exceeds a threshold value. Examples of threshold values for blood glucose levels are about 60, 70, or 80 mg/dL for hypoglycemia; about 70, 80, or 90 mg/dL for impending hypoglycemia; about 130, 150, 175, 200, 225, 250, or 275 mg/dL for impending hyperglycemia; and about 150, 175, 200, 225, 250, 275, or 300 mg/dL for hyperglycemia. The actual threshold values that are designed into the alarm system 104 may correspond to interstitial fluid glucose concentrations or electrode measurements (e.g., current values or voltage values obtained by conversion of current measurements) that correlate to the above-mentioned blood glucose levels. The analyte monitor device may be configured so that the threshold levels for these or any other conditions may be programmable by the patient and/or a medical professional. (Page 75; ll. 1-11). The display also includes various indicators 166 which may be activated under certain conditions. For example, the indicator 168 of a glucose monitoring device may be activated if the patient is hyperglycemic. Other indicators may be activated in the cases of hypoglycemia (170), impending hyperglycemia (172), impending hypoglycemia (174), a malfunction, an error condition, or when a calibration sample is needed (176). In some embodiments, color coded indicators may be used. Alternatively, the portion 164

		which displays the blood glucose concentration may also include a composite indicator 180 (see FIG. 24), portions of which may be appropriately activated to indicate any of the conditions described above.
Claim 92 (new)	**Claim 138 (new)**	
The computer system of claim 91, wherein the one or more boundaries comprise upper and lower boundaries.	The computer system of claim 137, wherein the one or more boundaries comprise upper and lower boundaries.	The alarm system 104 is triggered when the data from the processing circuit 109 reaches or exceeds a threshold value. Examples of threshold values for blood glucose levels are about 60, 70, or 80 mg/dL for hypoglycemia; about 70, 80, or 90 mg/dL for impending hypoglycemia; about 130, 150, 175, 200, 225, 250, or 275 mg/dL for impending hyperglycemia; and about 150, 175, 200, 225, 250, 275, or 300 mg/dL for hyperglycemia. (Page 75; ll. 1-6).
Claim 93 (new)	**Claim 139 (new)**	
The computer system of claim 92, wherein the upper and lower boundaries are user selectable.	The computer system of claim 138, wherein the upper and lower boundaries are user selectable.	The alarm system 104 is triggered when the data from the processing circuit 109 reaches or exceeds a threshold value. Examples of threshold values for blood glucose levels are about 60, 70, or 80 mg/dL for hypoglycemia; about 70, 80, or 90 mg/dL for impending hypoglycemia; about 130, 150, 175, 200, 225, 250, or 275 mg/dL for impending hyperglycemia; and about 150, 175, 200, 225, 250, 275, or 300 mg/dL for hyperglycemia. ... The **analyte monitor device may be configured so that the threshold levels for these or any other conditions may be programmable by the patient and/or a medical professional**. (Page 75; ll. 1-11).

Claim 94 (new)	**Claim 140 (new)**	
The computer system of claim 92, wherein the upper and lower boundaries correspond to upper and lower thresholds associated with hypoglycemic and hyperglycemic alarms.	The computer system of claim 138, wherein the upper and lower boundaries correspond to upper and lower thresholds associated with hypoglycemic and hyperglycemic alarms.	The alarm system 104 is triggered when the data from the processing circuit 109 reaches or exceeds a threshold value. Examples of threshold values for blood glucose levels are about 60, 70, or 80 mg/dL for hypoglycemia; about 70, 80, or 90 mg/dL for impending hypoglycemia; about 130, 150, 175, 200, 225, 250, or 275 mg/dL for impending hyperglycemia; and about 150, 175, 200, 225, 250, 275, or 300 mg/dL for hyperglycemia. (Page 75; ll. 1-6).
Claim 95 (new)	**Claim 141 (new)**	
The computer system of claim 76, wherein the processor module is configured to display a graphical representation of analyte concentration over a time period.	The computer system of claim 122, wherein the processor module is configured to display a graphical representation of analyte concentration over a time period.	The display 154 may also be capable of displaying a graph 178 of the analyte level over a period of time, as illustrated in FIG. 24. (Page 84; lines 17-18).
Claim 96 (new)	**Claim 142 (new)**	
The computer system of claim 95, wherein processor module is configured to display the graphical representation for a plurality of user selectable time periods.	The computer system of claim 141, wherein processor module is configured to display the graphical representation for a plurality of user selectable time periods.	The display 154 may also be capable of displaying a graph 178 of the analyte level over a period of time, as illustrated in FIG. 24. Examples of other graphs that may be useful include graphs of the rate of change or acceleration in the rate of change of the analyte level over time. In some embodiments, the receiver/display unit is configured so that the patient may choose the particular display (e.g., blood glucose concentration or graph of concentration versus time) that the patient wishes to view. The patient may choose the desired display mode by pushing a button or the like, for example, on an optional input device 162. (Page 84; lines 17-24).